

CLAIMS

1. Apparatus (10) for extracting gaseous, liquid and/or solid elements from a gaseous medium and
5 concentrating them in a liquid medium, by nebulizing this liquid medium by means of the gaseous medium and condensing the droplets of liquid medium forming the mist produced by this nebulization, the said apparatus comprising:
- 10 - a first enclosure (20, 120) for nebulization and condensation, which has an upper part (24, 123) and a lower part (21, 121) intended to contain the liquid medium, and which is provided with a conduit (35) for delivering the gaseous medium, means (31, 33, 131, 133)
15 for nebulizing the liquid medium, and a first conduit (45) for discharging the gaseous medium;
- means (60) for depressurizing or pressurizing the interior of the first enclosure to allow the gaseous medium to enter this first enclosure, circulate
20 therein and be discharged therefrom, in a continuous flow;
- and being characterized in that it furthermore comprises:
- at least one second enclosure (40) for
25 condensation, this second enclosure being connected to the conduit (45) for discharging the gaseous medium from the first enclosure, and being provided with a second conduit (50) for discharging the gaseous medium;
and
- 30 - means (52) for cooling this second enclosure.

2. Apparatus (10) according to Claim 1, characterized in that, the gaseous medium delivery conduit (35) of the first enclosure (20, 120) having a first end (35a) located outside this first enclosure
5 and a second end (35b) housed in this first enclosure, the means for nebulizing comprise:

- a nebulization nozzle (31, 131) which is located level with the second end (35b) of this conduit and which has at least one orifice (32, 132); and

10 - a nebulization tube (33, 133) provided with two openings (133a, 133b): a first opening (133a) which is located in the lower part of the first enclosure, and a second opening (133b) which is flush with the orifice (32, 132) of the nebulization nozzle (31, 131).

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3. Apparatus (10) according to Claim 2, characterized in that the nebulization nozzle (31) is formed by a reduction in the cross section of the gaseous medium delivery conduit (35) of the first
20 enclosure (20).

4. Apparatus (10) according to Claim 2, characterized in that the nebulization nozzle (131) consists of a piece attached to the second end (35b) of
25 the gaseous medium delivery conduit (35) of the first enclosure (120).

5. Apparatus (10) according to any one of Claims 2 to 4, characterized in that the orifice (32) of the
30 nebulization nozzle (31) is oriented towards the upper part of the first enclosure (20), and the second

opening (33b) of the nebulization tube (33) is located immediately above this orifice.

6. Apparatus (10) according to any one of Claims 2 to 5, characterized in that the first enclosure (20) is composed of three parts:

- a reservoir (21) which forms the lower part of the first enclosure and which is intended to contain the liquid medium;

- a nebulization chamber (23) which forms the intermediate part of the first enclosure and which houses the orifice of the nebulization nozzle (32) and the second opening (33b) of the nebulization tube (31); and

- a condensation dome (24) which forms the upper part of the first enclosure.

7. Apparatus (10) according to Claim 6, characterized in that, the second enclosure (40) having a base (41) and a top (46), the first conduit (45) for discharging the gaseous medium is a conduit with a bend which connects the nebulization chamber (23) of the first enclosure (20) to the base (41) of the second enclosure.

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8. Apparatus (10) according to any one of Claims 2 to 4, characterized in that the orifice (132) of the nebulization nozzle (131) is oriented towards the lower part of the first enclosure (120), and the second opening (133b) of the nebulization tube (133) is located immediately below this orifice.

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9. Apparatus (10) according to any one of Claims 2 to 4 and 8, characterized in that the first enclosure (120) is preferably composed of two parts:

5 - a reservoir (121) which forms the lower part of this first enclosure and which is intended to contain the liquid medium, which reservoir has a bottom (151) whose surface area is less than a cross section of this reservoir, this cross section being flush with
10 the surface of the liquid medium when the apparatus is operational; and

- a nebulization chamber (123) which forms the upper part of the apparatus and which houses the orifice (132) of the nebulization nozzle (131) and the
15 second opening (133b) of the nebulization tube (133).

10. Apparatus (10) according to Claim 9, characterized in that the reservoir (123) has a shape which tapers from the bottom upwards.

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11. Apparatus (10) according to Claim 9 or Claim 10, characterized in that the nebulization chamber (123) has two walls: an outer wall (123a) onto which the first conduit (45) for discharging the gaseous
25 medium is to be connected, and an inner wall (123b) which is located entirely above and at a distance from the reservoir (121), this inner wall dividing the nebulization chamber in order to form a central part (153) located inside the inner wall (123b) and a
30 peripheral part (154) located between the outer wall (123a) and the inner wall (123b), the second opening

(133b) of the nebulization tube (133) and the orifice (132) of the nebulization nozzle (131) being housed in the said central part.

5 12. Apparatus (10) according to any one of Claims 9 to 11, characterized in that, the second enclosure (40) having a base (41) and a top (46), the first conduit (45) for discharging the gaseous medium is a conduit with a bend which connects the nebulization chamber
10 (123) of the first enclosure (120) to the base (41) of the second enclosure.

13. Apparatus (10) according to any one of Claims 8 to 12, characterized in that the first enclosure (120)
15 comprises an element (167) for stabilizing the surface of the liquid medium, this element being intended to lie below and at a short distance from this surface when the apparatus is operational, while allowing the drops due to the condensation of the mist to pass
20 though.

14. Apparatus according to any one of the preceding claims, characterized in that the means (52) for cooling the second enclosure (40) are a Peltier effect
25 cell.

15. Apparatus (10) according to any one of the preceding claims, characterized in that the second enclosure (40) contains packing (42).

16. Apparatus (10) according to any one of the preceding claims, characterized in that the lower part of the first enclosure (20, 120) is provided with at least one system (22, 122) for detecting or
5 quantitatively determining the gaseous, liquid and/or solid elements extracted from the gaseous medium and concentrated in the liquid medium when the apparatus is operational.

10 17. Apparatus (10) according to any one of the preceding claims, characterized in that the lower part (21, 121) of the first enclosure (20, 120) is removable.

15 18. Apparatus (10) according to any one of Claims 7 and 8 and 12 to 17, characterized in that the first enclosure (20, 120) and the second enclosure (40) can be dismantled, and in that their constituent parts are connected together in a leaktight fashion when these
20 enclosures are assembled.

19. Apparatus (10) according to any one of the preceding claims, characterized in that it comprises means (60) for depressurizing the interior of the first
25 enclosure (20, 120), and in that these means are a suction pump which is connected to the second conduit (50) for discharging the gaseous medium.

20. Apparatus (10) according to any one of the
30 preceding claims, characterized in that it furthermore comprises an electrical power supply system (80)

comprising means for connection to an external electrical power source and electrical power supply means for its autonomous operation.

- 5 21. Apparatus (10) according to any one of the preceding claims, characterized in that it is in the form of a compact structure (11) which can be carried or pulled by a single person.
- 10 22. Method for extracting gaseous, liquid and/or solid elements from a gaseous medium and concentrating them in a liquid medium, by nebulizing this liquid medium by means of the gaseous medium and condensing the droplets of liquid medium forming the mist produced
15 by this nebulization, characterized in that said droplets are subjected to a condensation by coalescence on a wetted surface and to a condensation by contact with a cold surface.
- 20 23. Method according to Claim 22, characterized in that the condensation of the droplets by coalescence on a wetted surface and the condensation of the droplets by contact with a cold surface are carried out in two enclosures which are separate from each other but are
25 connected together.
24. Method according to Claim 22 or Claim 23, characterized in that the condensation of the droplets by contact with a cold surface is carried out in a
30 refrigerated enclosure which contains packing.

25. Method according to any one of Claims 22 to 24, characterized in that the liquid medium comprises one or more solvents selected from water, organic solvents and mixtures thereof.